

# DRAGON USER

International edition

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March 1985

*The independent Dragon magazine*

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take to  
the air**

**Sequential  
Files**

**Handling Interrupts**

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# DRAGON USER



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## How to submit articles

The quality of the material we can publish in  
Dragon (for each month) will be a very great  
extent dependent on the quality of the  
documents that you can make with your  
Dragon. The Dragon computer was launched  
on to the market with a powerful version of  
BASIC, but with very poor documentation.

Articles which are submitted to Dragon  
User for publication should not be more than  
2000 words long. All submissions should be  
typed. Please leave wide margins and a  
double space between each line. Programs  
should, wherever possible, be computer  
printed on plain white paper and be accom-  
panied by a tape of the program.

We cannot guarantee to return every  
submitted article or program, so please keep  
a copy. If you want to have your program  
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addressed envelope.

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- We 15 copies of Worlds of Flight from  
Microdeal in this month's competition from  
Gordon Lee (Front cover by Mike Gerard)

## Editorial

When the Dragon was first launched, one of the most common queries was nothing to do with the operating system or machine code, it had to do with the whereabouts of the mushroom in Madross and the Minotaur.

Some of the earliest independent Dragon software houses were also heavily adventure biased, notably Salamander Software, creator of the inscrutable Dan Diamonds.

FOR SOME REASON there is a remarkable affinity between Dragon owners and adventure games. Many of the recent game releases have been adventure orientated. Incentive has recently converted its Kelt Trilogy to the Dragon, while both Adventure International and Channel 6 have also released adventures. Now Compuserge has launched a version of the classic Colossal Cave.

This is not to say that Dragon owners are not interested in arcade games or more serious applications. There are as many standard shoot 'em up games for the Dragon as there are for most microes. Marie Miner, Grid Runner and Labor Zone have all been converted to the Dragon.

However, the adventure market still seems to have an irresistible attraction for Dragon owners. Witsensoft's Ring of Darkness and Return of the Ring have built up a dedicated band of followers, as has Dragon Data's El Diables.

Given the depressed state of the Dragon market generally, it is nice to know that there are some areas which are still relatively buoyant. Happy adventuring!

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Dragon 32

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Dragon 32

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# Revenge

ROMMEL'S REVENGE is a new game from Design Develop for both Dragon and Tandy owners. Originally written for the Spectrum, *Rommel's Revenge* is a version of the Battlezone arcade game.

The game, which costs £7.95, features 3D graphics with full perspective.

The object of the game, which is set on a futuristic battlefield, is to destroy the enemy tanks ploughing relentlessly towards you. The enemy tanks are remote controlled and come in two types, standard and super deadly. Both types are controlled by mobile fire control sensors which hover low over the battlefield.

You can avoid enemy shells by using the blocks and pyramids scattered around the battlefield as cover. But, your only defence against an air-launched anti-tank missile is

## ROMMEL'S REVENGE



DRAGON 64/65  
TANDEM 1024

to destroy it before it destroys you.

The game, which is joystick compatible, is available from Tandy dealers or direct from Design Develop, 2 Ashton Way, East Herringstone, Sunderland SP2 3PX.

## Bulletin Board

BRIAN LLOYD, author of *Saunder's Dragon Trainer*, is setting up a bulletin board for Dragon owners. It will run on a Dragon 64 with two disk drives, once British Telecom has installed another telephone line.

Dragon owners wishing to access the bulletin board will need a 300/300 baud modem and an RS232 interface.

Anyone who wishes to contribute to the bulletin board, or who has ideas about the kind of services it could offer, is invited to contact Brian Lloyd at 8 Hornbeam Walk, Witham, Essex.

## German network

A GERMAN Dragon club is looking to expand its contacts with Dragon owners in other countries. Interested parties should contact Rainer Hilg, Thorckoppel 176, 20506 Barmstedt, West Germany.

## Graphic design displays

ORION SOFTWARE has launched a graphic design pack for designing hi-res screen displays. The pack consists of 100 sheets of A4 paper marked out in a 256 x 192 screen. It costs £2.90, or £5.50 for two, from 44 Prince Street, Rochdale, Lancashire.

## Colossal adventure

COMPUHOUSE HAS written a version of the classic *Colossal Cave* adventure for the Dragon 64. The adventure is text based and only available on disk.

There is no text or save feature, due to the lack of space. The game, which should be on display at the 6809 show, costs £9.95 from Compuhouse, PO Box 166, 26652 Green Lakes, Lansing M13 5TH.

# Modems, networks and languages

THAMES TELEVISION has launched a weekly eight-part television series for serious computer users. The series, which started on Channel 4 on February 11 at 5.30 pm, will look at modems, networks and languages such as Logo and Prolog.

In addition, the series '4 Computer Buffs', will launch a new Prolog service for

schools. SchoLink. Other features will include news, gossip and data transmissions of software over the air. DFF enthusiasts will learn how to construct a light pen.

Finally, the series will be running an interactive bulletin board through Nottingham Building Society's Homelink mainframe.

## New releases

LEICESTER BASED Blaby Computer Games has released three new games in its *Dragon Gold Range*. *Olympic* is a sports simulation which consists of five different events in which you have to compete against the clock. *Cosmic Crusader*, with 34 screens of action, is an inter-planetary shoot'em up, while *Atty Rodda* is a strategy game where you must steal a precious stone protected by snakes, guards and mines. All three games cost £3.95.

Blaby, which now has 17 titles to its credit, is converting its games to the Tandy Colour Computer. *Atty Rodda* is done in the *Gold* and *Beats* are already available for the Tandy, also



## COSMIC CRUSADER



DRAGON 64

priced at £3.95.

In addition, Blaby hopes to show another three new games for the Dragon at the 6809 show in March.

## Power-up

TOUCHMASTER has increased the price of its power pack for the Dragon. The new cost of the pack is £9.95 plus £1.50 P&P and not £7.50 as reported in *Dragon User* last month.

The company also announced that it is unable to help with Dragon hardware problems. The Dragon-only telephone line has been discontinued and all inquiries to the company should be made on 0555 744770.

## The Demon

COTSWOOD Computers are to write Dragon software for the Unicorn modem. The modem which is being renamed the Demon, retails for £49.95 (see *Dragon User*, December

1994) and is produced by the Rushworth Cables group — the organisers of the 6809 show.

It is expected that Cotswood will be exhibiting the modem and software at the show which is being held at the Royal Horticultural Halls in London, from March 30-31. Further details from Rushworth Cables on 01-836 1012.

## Scramble

THE SCRAMBLE program in the February edition of *Dragon User* contained two errors. Line 1490 was misprinted. The correct data listing is: DATA 0, 8, 33, 128, 5.8, 0.0, 180, 248.8. Secondly, half of line 1990 was not printed. The complete line should read: 1990 IF JPER, (55280) AND 1)=0 AND 5, -4 THEN GOSUB 2110





FLIGHT SIMULATORS have come a long way since the early instrument-oriented "games". The latest programs include real time 3D graphics and accurately mimic the responses of a plane in flight.

Microdeal has just released *Worlds of Flight* for the Dragon, which comes in an impressive over-sized video style box with a full size flight manual. The simulation is "view" orientated — you see the view out of the window in real time 3D graphics, which move as the plane takes off and flies. The program takes its title from the fact that there are nine worlds which you can fly around in. These "worlds" are in effect just different landscapes, including mountains, cities, islands and gulfs. There is also a useful practice world which is completely empty, apart from the airport.

Getting real-time 3D graphics on the Dragon may sound like a minor miracle, but there have been a number of trade-offs to achieve this. All the graphics are shown as wire frame drawings, rather than solid objects. The technique used is to define each world as a series of points in a three dimensional model. These points are then transformed into the camera's frame of reference and projected on to the screen.



The resulting points are then joined up by lines. This method is a very memory efficient technique and works quite well. However, some users might find it hard to visualise the 3D effect with just wire frames.

*Worlds of Flight* is written entirely in machine code and requires two potentiometer joysticks. Please note that some switch type joysticks that are now available for the Dragon cannot be used as the simulator needs to sense the position of the sticks.

After a fancy title page showing your plane, which is apparently an experimental sport trainer, doing an aileron roll, you are presented with the "Define Worlds" section. This allows you to define which world out of the nine you want to fly in. It is also possible to change the wind speed and direction, as well as setting the "Ceiling" below which the ground and other landmarks are visible. Pressing the Enter key starts the simulation.

The upper half of the display (Pmode 4) shows the view out of the aircraft's window, the lower half shows all the instruments. The airport view is always the same in every world, with the runway,

**Brian Cudge takes to the skies in this review of two flight simulators**

control tower, fuel stations and fire station. Using the keyboard, it is possible to pan around (the equivalent of moving your head left to right, or up and down, this is controlled by the arrow keys. Another useful viewing option is the Radar, which gives a bird's eye view of the current world, with a cross marking the plane's position. You can even zoom in on the radar.

The instrument panel shows all the essential flight information, such as a fuel gauge, speed, engine speed, artificial horizon (shows which way up you are), altimeter, compass, rate of climb, brake indicator and landing gear indicator.

The up/down movement of the left joystick controls the throttle, and the left/right movement controls the rudder. The up/down movement of the right joystick con-

Another flight simulator of a slightly different type to Microdeal's is *747 Flight Simulator* by DACC Ltd. As is obvious from the title, this program attempts to simulate the operation of a 747 Jumbo Jet. Again, two potentiometer joysticks are needed to use the program, and the display is a Pmode 4 screen with the upper half showing the pilot's view and the lower half the instrument panel.

The operating instructions come in a small booklet, the same size as a cassette case. I was somewhat surprised to see that the program is written in Basic, and this is reflected in the speed and complexity of the graphics.

The first six pages of the manual describe the theory of flying a 747 in a well written introduction, though it doesn't refer to the program or its operation at all. Next, comes a description of the instrument panel. None of the instruments are labelled, which is unhelpful as there are 16 small dials on the right hand side of the display alone, giving information about each of the four jet engines. The other main gauges displayed are airspeed, artificial horizon, compass, speed, altimeter, rate of turn, and brake and landing gear indicators. But, each instrument is described in detail in the manual, which is generally well written.

The controls are once again via the joysticks and the keyboard. One joystick (the manual doesn't tell you which — perhaps it's more fun to find out for yourself) controls the left/right banking of the aircraft, and the two up/down, and the other joystick is used as the throttle lever. Keyboard characters control things like brakes, landing gear, flaps etc.

The pilot's view is 3D, but you couldn't get much more basic — a couple of angled lines show the runway. Again, the operation of the aircraft is fairly accurate, which is probably why the program is so slow. If you specifically want a jumbo jet simulator, then you might consider this one.

The program itself is not bad (even if it is in Basic). Perhaps it is unfortunate that DACC's flight simulator is being compared to Microdeal's, as the latter is certainly well above the usual standard with superior features.

<b>Program:</b> 747 Flight Simulator	<b>Cost Supplier:</b> £9.95 DACC Ltd, 23 Waverley Road, Greater Manchester M20 3BN
<b>Worlds of Flight</b>	<b>£8.00</b> Microdeal, 41 Thoro Road, St Austell, Cornwall PL26 5JE

trols the elevator (it makes the nose go up or down) and the left/right movement controls the rati rate.

Pressing both joystick buttons at once starts the engine, and since the brakes are released the aircraft begins to tail along the runway. Following the suggested procedure for taking off in the manual, it is quite simple to become airborne. However, I found it is a lot harder to land successfully!

It is apparently possible to do a number of aerobatics in the air, but plenty of practice is needed first. Once you've mastered simple flight, you can land and taxi at any airport and continue the flight through the various worlds.

The most important part of this simulation is, undoubtedly the graphics. These are rather free, but rather slow. Also, from some angles, objects such as the control tower become twisted and totally unrecognisable. Having said that, the graphics are still by far the best I have seen on a Dragon flight simulator.

The other important aspect of any flight simulator is how accurately it copies the plane's responses. *Worlds of Flight* scores highly here — the program is very accurate in most situations.

## Draconian measures

**Program:** Draconian, Microdeal, 41 Turo Road, St Austell, Cornwall. Price: £7.95

THIS IS a space chase game that has similarities to both Phoenix and Asteroids as well as showing a certain amount of influence from Star Trek. The playing area consists of a series of interconnecting sectors, each containing several triangular enemy bases. The object is to destroy these bases and thereby free astronauts held captive inside. The astronauts have then to be transported from one sector to the next, each stage getting progressively more difficult.

After choosing the background from a selection of black, white or green, in the usual Tam Liki fashion, the display reveals the main viewing screen and a long range sector scanner on the right. The latter shows your position as well as that of the enemy bases. Your vessel remains in the centre of the playing area, but can be pointed in any one of eight different directions by means of the joystick, while a background of stars and satellite pass by, giving the illusion of movement.

The fire button releases a stream of shots in the direction of the ship's movement which

will destroy almost anything in the way. Unfortunately, if you fly into the resulting explosion, you too end up as a space statistic.

Should you manage to collect all the apparatus, the sector scanner flashes at the top to show that the exit gate is open, and you can fly through this into the next sector. Points are awarded according to the number of astronauts safely transported through the exit gate. To open up the game, enemy vessels called Dragons occasionally pursue you. Luckily, these can be shot down, which unfortunately is not the case with the Draconian, an unpleasant craft which appears if you take too long to destroy all the enemy bases.

There is on-screen scoring, one or two players can take part, and the game is nicely graded, getting more difficult as you progress. About the only thing I didn't like was the slow method of getting your name into the high-score table by using the joystick rather than the keyboard — a point-less hangover from the arcade version.

John Scivven



## Move over pole position — here's speed racer

**Program:** Speed Racer, Microdeal, 41 Turo Road, St Austell, Cornwall. Price: £7.95

THESE HAVE been several attempts to produce motor racing games for the Dragon, but most show a view from above or from the side and fall far short of the versions available for Atari or Commodore computers. At last there is a version for the Dragon that can compete with games like Pole Position — in fact, it's surprising what excellent graphics have been achieved in Speed Racer.

When the game has loaded, the background can be selected, although to get a

really clear picture it's worth sacrificing colour in this program and choosing a black background. The title graphics are very clever and show a computer sitting on a checkered flag with the title and author's name appearing on the monitor. The screen then clears to show mass of four different circuits. Moving the joystick jumps from one to the next, and pressing the fire button selects the particular track around which you race.

The display now shows the view from just behind the car, with the track stretching away into the distance, complete with starter waving a flag. The joystick controls left and right

movement as well as acceleration and braking, and the front wheels of your car can be seen responding. The object of the game is to overtake as many other cars as possible. Indeed, should you fail to pass enough of them, you will find the game finishes after one lap, so that you know how many you need to overtake. There is an indicator at the bottom of the screen next to the speedometer.

As the race starts, one thing that is noticeable is the attention to detail. The track swings, from left to right and the background of mountains, houses, bridges, etc. moves as well, giving an excellent impression of actually being on a racing circuit. Keeping on the track is not too difficult, but there isn't much room to spare when you attempt to overtake.

Should you touch one of the other cars, there is an explo-

sion and bits of the car fly into the air, complete with relevant sound effects. You are not penalised when you have a collision, but it takes some time to catch up with the pack when you restart. If your steering isn't all it should be and you veer on to the hard shoulder too frequently, the car stops and a little figure arrives to fit a new set of tyres!

Although I enjoy well-written arcade games and simulations, it's not often that I find one that is so addictive as Speed Racer. When you've mastered the easy circuit you can go on to one with more bends, if you can last ten miles, a figure appears with a checkered flag and your time is recorded under the circuit name. One of the best games I've seen for ages.

John Scivven



## Jailbreak — Cuthbert rides again

**Program:** Cuthbert in the Cooler, Microdeal, 41 Turo Road, St Austell, Cornwall. Price: £7.95

MICRODEAL HAS been producing Cuthbert games for some time now, and there seems no end to the assortment of stripes he gets himself into. The first few were mainly arcade games, with a more elaborate plot, but they have gradually become graphic adventures of increasing complexity. In the latest chapter in the saga, we find Cuthbert trapped in a prisoner of war camp, in dire need of speedy release.

The first screen shows an aerial view of the camp, and the task is to get the key from one of the guards and take it to the gate. The number of guards varies according to the difficulty level chosen, and ranges from two to eight. Cuthbert has to avoid the attentions of these guards or else they will arrest him. Luckily, the bullet-travel rather slowly, and he can avoid them and even cause the guards to shoot each other, so gaining extra points. Using the fire button speeds

up his progress, but decreases the energy level.

If Cuthbert can reach the gate, he is faced with the problem of getting some identity papers from one of the guards and crossing a marsh to a bridge. Using a joystick means this task is quite difficult. The last screen sees him acquiring some money and taking a boat towards the border. The graphics aren't bad in this game, though not up to the most recent programs. Beyond the first screen the going gets quite tough, however, and you have to have very nimble fingers to reach the bridge safely. If you fail to avoid the guards, or take an early bath in the marsh, there are two more Cuthberts waiting in the wings to join the struggle for freedom.

This game has a fair amount of originality to it, but doesn't have the compulsiveness of Cuthbert in the Jungle (still my favourite), and the overall program, although reasonable, isn't quite up to others in the series.

John Scivven



# The Second 6809 COLOUR SHOW

**FOR DRAGON AND TANDY USERS**  
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Buses 11, 24, 29, 70, 76 and 88 run up Victoria Street.

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6809 is the registered name of Motorola Ltd.



# Expansion port

Myriel Francis provides a new Dragon expansion system

PACE ELECTRONICS latest offering from its array of add-ons is a "Dragon expansion system". The expansion system comprises two separate parts, an interface cartridge with four LED indicators and the main expansion cartridge housing unit which is referred to in the users guide as the "back-plane unit". The interface is housed in an ABS plastic case with support legs, while the back-plane is manufactured out of steel that has been plastic coated.

The two units are connected by a 50-way ribbon cable. The cable is permanently connected to the back-plane, but is attached to the interface by an indirect edge connector and may be removed if you wish.

The interface cartridge holds the system buffers and the multiplexer. Since the system is buffered, the unit can change cartridges while the back-plane is switched off, but the computer is on. The back-plane has its own power supply, which is a must. The Dragon's own power supply is totally inadequate to run four separate cartridges at any one time.

The unit uses only one location of the Dragon's memory (BHEFF). This location is Poked with the number of the slot you wish to invoke (0-3).

## 68009 interrupts

Interrupts are signals to the CPU to temporarily halt what the CPU is doing and redirect it to another task. The Dragon only makes use of two of the 68009 interrupts, the Fast Interrupt (FIIRQ) and the Non-Maskable Interrupt (NMI).

The expansion unit handles any cartridge designed for the Dragon using these interrupt lines. However, problems may be encountered in the rule that some cartridges handle interrupts. Switching from the slot containing this type of cartridge may result in an interrupt occurring at the switching moment, causing the processor to behave in an unpredictable manner.

To overcome this problem, the designers of the expansion unit recommend that such cartridges should be placed in any slot other than 0. The cartridge may now

be selected in the usual way. When the time comes to exit that cartridge you simply RESET the Dragon, which will default to slot 0.

One cartridge that handles the interrupts in an odd manner is Dragon Data's disk interface. Unfortunately, it needs one of the 68009 interrupt lines in an active low condition during "stand by". But Premier DOS owners will be pleased to know that their interface does not behave in a suspect way.

Figure 2

PROSPECTIVE CARTRIDGE PINOUTS			
01	+12V	25	Address 3
02	+12V	22	Address 4
03	HALT	23	Address 4
04	NMI	24	Address 5
05	68009	25	Address 6
06	68009	26	Address 7
07	68009	27	Address 8
08	68009	28	Address 9
09	+5V	29	Address 10
10	68009	30	Address 11
11	68009	31	Address 12
12	68009	32	DATA
13	68009	33	DATA
14	68009	34	DATA
15	68009	35	68009
16	68009	36	DATA
17	68009	37	Address 13
18	Fixed for use	38	Address 14
19	Address 0	39	Address 15
20	Address 1	40	End row

One method of removing cartridges from the back-plane is to switch off its power supply while retaining a supply to the computer. However, this will affect either the FIIRQ or the NMI lines causing unpredictable behaviour to the 68009 which

usually results in a crash. Pace has provided information on three Poke statements within their user guide to overcome this corruption of the interrupt lines.

The 16-page users guide supplied with the system is concise and easily read. Besides containing all the codes needed to run the system, the guide also gives details on how to utilise the Dragon 84's built-in RESET as well as using add-on RESET units for the 32.

Three applications are fully documented in the users guide. File transfer between Dragon DOS and the Premier Delta DOS and vice versa, BASIC and machine code programs from disk to EPROM, which can then be used in the sideways ROM bank, and the third application which describes how to download a program via RESET and store the data in EPROM.

Figure 3



Pace also included a hard copy of a relocation utility in BASIC and a 68009 assembler version written in position independent code (PIC). The utility is actually two programs in one — the first is a "keep" utility that takes the BASIC program from its original storage area and then stores it in a free part of RAM. Once the desired section of the utility may be invoked, which reverses the process carried out by "keep". You now have a BASIC program in the right position for execution or saving via RESET to another computer or to EPROM.

## Conclusion

This unit is extremely versatile. It really does expand the capabilities of your Dragon, whether you just wish to have four game cartridges at hand, or create a powerful 68009 development system. A great deal of thought and development time has been spent on trying to create a product that could be used with every type of commercially available and home-spun cartridge power Dragon DOS, and it shows. The cost of the unit that has not been finalised at the time of review, but it is expected to sell for around £130, which would make it a worthwhile investment.

Figure 1. Expansion system







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```

100 Y=Y-20:SY=SY+20
102 FOR I=1 TO 4
104 X=X+20
105 CH=CHR$(Y%IF CHR$(Y% OR CHR$(Y% THEN 105
106 REM*****SETS COLOUR*****
107 CH(I)=VAL(CH)
108 IF CH(I)=0 THEN 110
109 CIRCLE(X,Y),.5
110 IF CH(I)=2 THEN 112
111 CIRCLE(X,Y),.5:PAINT(X,Y),.6
112 IF CH(I)=3 THEN 114
113 CIRCLE(X,Y),.5:PAINT(X,Y),.7
114 IF CH(I)=4 THEN 116
115 CIRCLE(X,Y),.5:PAINT(X,Y),.8
116 IF CH(I)=5 THEN 118
117 CIRCLE(X,Y),.5:CIRCLE(X,Y),.2
118 IF CH(I)=6 THEN 120
119 CIRCLE(X,Y),.5:CIRCLE(X,Y),.2
120 NEXT I
121 REM*****RIGHT COLOUR*****
122 CR=0
123 FOR P=1 TO 4
124 IF CR<>CH(P) THEN 126
125 CR=CR+1
126 NEXT P
127 REM*****END OF RIGHT*****
128 IF CR=4 THEN 164 ELSE GOTO 131
129 IF T=7 THEN 131
130 REM*****WONS PLACE*****
131 WP=0
132 FOR P=1 TO 4
133 FOR N=1 TO 4
134 IF WP THEN WN=N+1
135 IF CR<>CH(N) THEN 137
136 WP=WP+1
137 NEXT N
138 NEXT P
139 REM*****SETS WONS SPOTS*****
140 IF WP=0 THEN 146
141 FOR P=1 TO CR
142 SX=SY+0
143 PAINT(SX,SY),.6
144 NEXT
145 REM*****SETS PLUS*****
146 IF WP=0 THEN 151
147 FOR P=1 TO WP
148 SX=SY+0
149 CIRCLE(SX,SY),.2
150 NEXT P
151 NEXT T
152 REM*****YOU LOST*****
153 CLS
154 FOR YL=0 TO 400
155 PRINT#VL,CHR$(126);"Y O U L O S T . . . "
156 NEXT YL
157 PRINT#VL,"*****";
158 PRINT#VL,"OF H E S S S P A C E";
159 PRINT#VL,"*****";
160 PLAY"V30D1T3L400L00-400P#0"
161 ON=INSTR$(OF,OF) THEN 161 ELSE IF ON="" THEN 40
162 GOTO 40
163 REM*****YOU DID IT*****
164 CLS
165 FOR YD=1 TO 400
166 PRINT#VD,CHR$(126);"Y O U D I D I T ! !";
167 NEXT YD
168 PRINT#VD,"*****";
169 PRINT#VD,"OF H E S S S P A C E";
170 PRINT#VD,"*****";
171 PLAY"O30D1T3L400L00-400P#0"
172 ON=INSTR$(OF,OF) THEN 172 ELSE IF ON="" THEN GOTO 40

```

# Doodling

John Smith presents a turtle graphics type drawing program

SINCE IT is not too difficult to write a program which allows drawing on the Dragon's lines screen, with the ability to give a screen dump on to the Tandy CGP 115, I decided to startle with something approaching turtle graphics. The short listing which follows is approximately 2184 long, and quite easy to enter. Even if you have not got a Tandy (or similar) computer, you will still get some preliminary insight before investing in a full scale professionally written package.

Only four commands are used and, since this is by no means a full implementation of turtle graphics and the finished drawing often resembles the doodles on the carrier of my memo pad, I have christened the name to my title — "DOODLE".

On running the program you are first presented with two introductory screens with instructions for entering data. At start up, the program sets the drawing turtle at the centre, and facing towards the top of the screen (ie, to 12 o'clock on a clock face).

The first request is to ENTER the length of the line that you want the turtle to draw. The units used are single pixels in Process 4. This means that a line going in any direction of a length greater than 128 from the centre will give an error message of being off screen. Lengths of 40-60 should be sufficiently large to produce a useful size without producing this error.



Figure 1

The next request is for an angle. Since the turtle is facing up at the start, an input of 90 means that the first line will be drawn to the right (or 3 o'clock) while an input of 120 will draw to 4 o'clock, and so on. The next command appears as REPEAT,

which refers to the number of times you want the line of the length you have entered to be drawn at the specified angle.



Figure 2

If we take a line of 40 units and an angle of 120 degrees drawn three times, we will end up with the drawing in Fig 1. You will see that the rotation of the line is clockwise (although this can be altered to anticlockwise by entering a negative value for the

angle) and that the angle is on the outside of the triangle so you do not specify 60 degrees to draw a triangle.

This gives a simple rule for drawing polygons, namely 360/number of sides = the angle to be used for drawing. Thus, a pentagon is drawn by 72 degree angles and an octagon by 45 degrees. With a sufficiently large number of sides, the drawing approaches a circle (try angles of 10 degrees repeated 36 times).

The whole program relies on simple trigonometry to produce its effects and the equations used are at the sub routine on line 3080. Fig 2, helps explain how these equations are derived.

Since  $\sin Z = A/C$  and  $\cosine Z = B/C$ ,  $A = C \times \sin Z$  and  $B = C \times \cosine Z$ . Therefore  $X1 = X + A$  and  $Y1 = Y + B$ .

Each time the sub routine is called, X1 and Y1 are recalculated for each increase in angle by Z (Z being the angle converted to radians by dividing by 180pi, which equals 67.36577951).

The command to vary the line is LENGTH VARIATION. This changes the

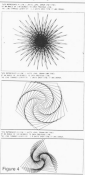


Figure 4

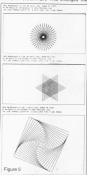


Figure 5



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# Sequential files on tape

Robin Hamilton explains how sequential file techniques can be used to create a 200K database on tape

THERE ARE numerous database programs in existence for the Dragon 32, from the simplest to the most complicated, both commercial tapes and listings published in magazines. Unfortunately, most that rely on cassette rather than disk for data storage have a radical limitation — they accept the 32K memory of the Dragon as an upper limit for the total amount of data which the program can deal with.

For simplicity's sake, "DB" is used as shorthand for whatever amount of memory is left for string data, after the Basic program has taken its bite, and the memory has been further used up by

dimensioning arrays, assigning variables, and so on. This will obviously be less, often much less, than the notional 32K available initially after POLEAR has been executed.

The following sort routine is a standard version of the Shell sort, but it makes use of the Dragon's **WARPTR** function. It can be between fast and 10 times faster than a sort program which directly switches arrays rather than (as this does) switching the array pointers ( $N$  = number of items to be sorted and  $DB$  number) is the array holding these items).

Next, you should examine the **LOAD**

and **SAVE** routines. These come in two forms. The simpler reads or writes a number at the start which gives the number of items in the array to be saved or loaded. This number is then used when reading or writing data to or from tape, to indicate when to stop loading or saving. For our purposes, this is quite useless as it effectively prevents a file on tape from being appended to one already in the computer. The routine to use, more complicated but more elegant, is the one which employs the Dragon **GOF** function.

There are a number of techniques which can be used to extend this limit to the maximum amount of data which can be held on cassette rather than in Ram. Conceivably, a two-hour audio-cassette could be used to hold the data, but there is an overhead in terms of time — accessing the final item of data on a two-hour cassette, however you go about it, does take two hours. But, using the techniques described here, it should be possible to create a database of about 200K on a C20 cassette, and access it relatively easily.

## Original database

There are certain features your original database program should have. These are:

- Routine to create file
- Routine to insert, amend, and delete records
- Routine to find and save data to tape
- Routine to search the records

A set routine to arrange the records in order

All these routines are fairly standard. The only one which is sometimes omitted from database programs is the sort routine. If you are buying a database program, or building one from scratch, make sure you pick one with a sort routine. If you have a database program without a sort routine, write one in as a subroutine.

Here are the bad and the good versions (Figs 2 and 3) — if you keep the former, simply replace it by the latter. Both versions presuppose a variable  $N$  in the program which holds the number of items currently in the file, and an array  $DISP$  (page number greater than  $N$ ) created by the program to hold the records.

The purpose of the variables in line

```
7500 REM *** SORT SUBROUTINE ***
7505 N=N-1
7510 CLS: PRINT "SORTING ... PLEASE WAIT"
7520 T=1
7530 Y=2BY
7540 IF T<N THEN 7530
7550 Y=INT(Y-1)/2
7560 IF Y=0 THEN 7530
7560 IT=N-Y
7570 FOR I=1 TO IT
7580 J=1
7590 M=J+Y
7600 IF DB=1 OR DB=2 THEN 7640
7610 NEXT I
7620 GOTO 7550
7630 CLS: PRINT "SORT COMPLETED"
7630 M=M+1: RETURN
7640 FOR C=0 TO 2
7650 B=C: IF B=0 THEN B=B+1
7660 T1=PEEK(WARPTR(DB+1)+B)
7670 T2=PEEK(WARPTR(DB+1)+B+1)
7680 PEEK(WARPTR(DB+1)+B+1)=T1
7690 PEEK(WARPTR(DB+1)+B)=T2
7700 NEXT C
7705 J=J+Y
7710 IF J>N THEN 7690
7720 GOTO 7610
```

Fig 1

1000, and then use in line 1000, rather than the more obvious 1 TO M will emerge in due course. This part of the routine is actually simpler than the earlier version, since you don't have to print the number to the tape to start with!

This routine is at once more elegant and less easy to understand than the earlier version. What it does is read the tape and, if the end-of-tape marker is encountered, restart from whence it was called. Otherwise, it increments the variable counter holding the number of items in the file by one, reads one data item from the tape into the array set up in the program to hold the records, and then repeats the process until the end-of-tape marker is found. At this stage, it will return to the main program with N set to the number of items currently in the file. If there is no data in the program to start with, then N will equal the number of items loaded; if the program already holds data, then N equals the number of items held plus the number of items loaded.

```
1000 REM *** END SAVE ROUTINE ***
1000 OPEN "O", B=1, "SAVE"
1000 PRINT B=1, N
1000 FOR A=1 TO N
1000 PRINT B=1, DATA
1000 NEXT A
1000 CLOSE B=1
1000 RETURN
```

```
1000 REM *** END LOAD ROUTINE ***
1000 OPEN "I", B=1, "LOAD"
1000 INPUT A=1, N
1000 FOR A=1 TO N
1000 INPUT B=1, DATA
1000 NEXT A
1000 CLOSE B=1
1000 RETURN
```

#### Fig 2

Incidentally, if you want to save a string beginning with double quotes, simply replace INPUT by LINE INPUT. This follows the same syntax and has the same constraints as LINE INPUT taking data from the keyboard.

With a SORT routine included, and the EOF version of the LOAD/SAVE routine, we now have the program running and can work within the 32K limit. Now we add the file.

```
1000 REM *** END SAVE ROUTINE ***
1000 B=1 : GOTO
1000 OPEN "O", B=1, "SAVE"
1000 FOR A=1 TO N
1000 PRINT B=1, DATA
1000 NEXT A
1000 CLOSE B=1
1000 RETURN
```

```
1000 REM *** END LOAD ROUTINE ***
1000 B=1 : GOTO
1000 OPEN "I", B=1, "LOAD"
1000 INPUT A=1, N
1000 FOR A=1 TO N
1000 INPUT B=1, DATA
1000 NEXT A
1000 CLOSE B=1
1000 RETURN
```

#### Fig 3

The first bit is the ability to APPEND files from tape, which will be essential later. This will enable you to create two separate files, add them together, and

merge them using the SORT routine (assuming, that is, that the files are in the same form — for example, simple strings held as part of a string array). Even this by itself can be useful, if you can imagine five separate Dragon programmers each putting some items into a database of their individual computers, then jelling together to combine the files. In terms of PCs,

with the second part of the original file and the second part of the new file. (Save this file on the same tape that you saved the combined part one, immediately after it. If this is done correctly, you will now have a cassette containing approximately 80K of data in an ordered sequence.)

The purpose of the variables B and C should now have emerged — they allow us

```
2000 REM *** SPLIT FILE IN TWO ***
2010 INPUT "BREAK FILE AT WHICH LETTER": LB
2020 B=1
2030 IF LEFT$(DATA$(LB),1) THEN 2050
2040 B=B+1 : GOTO 2010
2050 INPUT "PRESS ANY KEY TO SAVE FIRST FILE": B
2060 B=1 : B=B+1
2070 GOSUB 1010
2080 INPUT "PRESS ANY KEY TO SAVE SECOND FILE": B
2090 B=B+1 : B=B+1
2100 GOSUB 1010
2110 PRINT "SAVE COMPLETED"
2120 RETURN
```

#### Fig 4

this would spread the misery of data-entry five ways.

When the program is first run, N is set to 1. This is because the program creates an end-of-tape marker when it is set up, which will always come at the end of the final file in a series on tape. The main menu will present an option "3. LOAD FILES FROM TAPE". When option 3 is chosen, you're sent to the LOAD subroutine at line 1000, the file is loaded from tape, and N is now set to the current number of items in the file. To append a further file, simply use the same option as it stands.

As the new file is loaded, N is incremented by 1 as each record is input, and when the file has finished loading, you're returned to the main menu with N now read to the number of items in the file currently held by the program. You can now carry on adding files up to the limit of the computer memory, and merge these files into one by means of SORT.

Assuming that we have now created a data file which takes up the whole of the available computer memory, and wish to add to this, what do we do? This is the second bit, the reverse of APPENDING files. We break the file into two parts (Fig 4).

By the use of this routine, we can create two separate files, each of which (ideally) will take up approximately half of the available computer memory. Further items can now be loaded into the file.

First, start a completely fresh file and input records up to the limit of available memory, or until you reach a convenient point to process this file. SORT this new file into order, and divide it into two of the same point that you divided your original file. Clear the program, and load in the first part of the original file, then append the first part of the new file to this, sort the result, and save the new, large sorted file on a fresh tape.

Next clear the program and do the same

to break into the SAVE routine and specify which parts of the file currently in the program are to be saved. This would originally be set up as part of an initialization routine something like the example in Fig 5.

The process of splitting files, adding to them, and recombining, can be done indefinitely, up to the limit of data that the cassette can hold. The problem with this is that only part of the data can be held in the Dragon's memory at any one time.

```
100 CLEARB1 : CLEAR 20000
110 DIM DB(500)
120 B=1 : B=1 : B=1
130 DB(1)="XXXXX"
```

#### Fig 5

```
10 DIM
100 CLEARB1 : CLEAR 20000
110 DIM DB(500) : DIM TB(500)
120 B=1 : B=1 : B=1 : CT=1
130 DB(1)="XXXXX"
```

#### Fig 6

To get round this problem, we create a routine to search each of the files on tape one after the other, and to store the results of this search in an array which has been created specially to hold them. At the moment, our initialization routine has created an array DB(4) to hold our records, and sets N=1 : B=1 : C=1. We now add TB(50), to create an array of 50 elements to hold items found by the search program, and a variable flag CT, which will signal whether the search routine is to simply scan the file currently in memory, or is to load further files and scan these too. The beginning of our program will now read something like Fig 6.

A very primitive search routine, which would search through a complete file for

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the occurrence of a specified string, and store the results of this search in a temporary file, as contained in Fig 7.

Lines 3060 and 3070 mean that if the QT flag is set to 1, or if the last record in the current file is "ZZZZ" (the end-of-tape marker), then the search will be terminated after the current file in memory has been searched. Otherwise, the computer will automatically load a further file from tape, search it, and store the results of the search in TS. Lines 3080, 3090, and 3100 blank the array without destroying the contents of the variables, call the LOAD subroutine, and start the SEARCH routine once more on the new file just loaded.

### Automatic scanning

If you want to simplify the process, or make the scanning of multiple files automatic, simply omit lines 3060, 3080 and 3090.

Assuming that the files to be searched are stored one after the other on a single tape, then the computer will get on with the job of searching without needing any attention at all the search has been completed. This process may be time-consuming, but as it is automatic, you can busy yourself at other pursuits (or trying to work out where to get the money to buy a disk drive, and make such expedients as this unnecessary) until the search has been finished. Possibilities here would be to make the computer set off a repeated beep when the search is finished to draw your attention to it, or have the search output its results to the printer rather than

```

3000 REM *** SEARCH SUBROUTINE ***
3005 CLN: INPUT "SEARCH MULTIPLE FILES (Y/N)?" N
3010 IF N="Y" THEN CT=0 ELSE CT=1
3015 INPUT "TYPE IN WORD TO BE SEARCHED FOR:" W
3020 T=0
3030 FOR A=1 TO N
3040 IF INSTR(DR1A),W)>0 THEN T=T+1: DR1A=DR1A+1
3050 NEXT A
3060 IF CT=1 THEN 3000
3070 IF DR1A="ZZZZ" THEN 3000
3080 FOR A=1 TO N: DR1A=" " : NEXT A: N=N+1
3090 GOSUB 1210
3100 GOTO 3030
3110 PRINT "SEARCH COMPLETE"
3120 RETURN

```

Fig 7

storing them in a temporary array in the computer memory.

With these various fairly simple routines implemented as part of your database program, this program will now be able to deal with a much greater amount of material, both in terms of storing the material and processing it. The examples given in this article are, obviously, as close to the bare bones as can be, but this is no reason why the same techniques — or appending files, splitting files, merging separate files, and selecting through a multiple set of files on tape, can't be incorporated into the routines of much more sophisticated database programs.

The real difficult technique to imple-

ment is probably the routine to search through a series of files, but even this is fairly straightforward if you recognise what is being done — rather than terminating the search when the file in memory has been examined, a fresh file is loaded and the search routine is simply run on this new file. The price paid for using the cassette in this fashion, as if it were a sequential disk drive, is not so much the programming involved, since the Dragon cassette routines are very much the same as certain disk routines, but the time it takes to access data. However, even this is partly compensated for when such access is automatic, and the computer can be left to attend to this by itself. ■

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# Task Master

John Nash looks at some of the mysteries of the interrupt routine

MULTI-TASKING IS common on larger computers and refers to the operation of two or more procedures or programs at the 'same' time. Actually, the programs are interleaved so that, for example, the processor can update the video display while waiting for the operator to press the next key. One way of achieving this is by using interrupts.

Interrupts are signals sent to the processor, for example a peripheral is ready to donate or accept data. They cause the processor to stack enough information to remember where it was working, then jump to the interrupt service routine. When the service routine is finished, the processor can return to its previous task. The effect is rather like being called to dinner while you are reading your programmer's manual: you mark the place, then go to

dinner (service the interrupt). Afterwards, you carry on from the place you marked.

How does this apply to the Dragon? You may have noticed that the Dragon becomes totally unresponsive while printing programs or data on to paper. This is because the processor waits in a loop, constantly checking a flag for printer 'not busy'. As soon as the flag is clear, the next character is sent to the printer (to see how this works, inspect your ROM contents from \$8CF8 to \$8D08). This loop wastes a lot of time, as the printer is very slow compared with the processor.

There is an alternative method that can be used — the printer has an acknowledge (ACK) line which is connected to the IRQ (fast interrupt) input, and can be used from machine code. The Dragon operating system does not use it. Two examples of

programs using this interrupt are described below.

1) A Basic program interpreter (Fig 1), which first copies an expanded (ie de-tokenised) version of the listing into upper memory. This is necessary to isolate the Basic program (and especially current line buffer) from the listing so that you can actually do something useful while the program is listing. You will find that you can now use the Basic system to edit, calculate or debug program while the printer is working. There is a limit on program length of about 8K bytes, but you could fit in a longer program by doing a PCLDARH operation with H=4. The program will warn you if the expanded version is too long to fit into the top half of memory.

Fig 1

2) This is an interrupted printing routine (Fig 2) which can be used with a word processor. It assumes that the text will start at address 138000 decimal, and the following codes are used:

```
CHAR(0)  = NEWLINE
CHAR(1)  = NEW PARAGRAPH
CHAR(16) = DOUBLE SPACE
CHAR(25) = SINGLE SPACE
```

These could be altered to suit text from any word processor.

Both routines are intended as illustra-

tions of the interrupt (output) method, to encourage you to experiment. Please use any parts of them that seem useful in your own programs.

To load these programs, first clear the memory space:

```
CLEAR $80000FF by BASIC/3
CLEAR $80000FF by BASIC/2
```

Next load the text dump into DATA statements (one program at a time). The left hand column holds the addresses while, the remaining 16 columns add the

data (instructions). Do not, therefore, load the left hand column. Your first DATA line for BASIC/2 should start:

```
10 DATA 1A,10,DE,18AC,00,00
```

When you have loaded all the DATA into lines 10 onwards, enter the following:

```
1 RUN:START PRINT:RUN
2 FOR N=0 TO 1
3 READ ADDRESS/VAL/INT - ADDRESS IN
4 END
```

and RUN 3. START is \$80F04 and FIN-

ENR is AHEAD for ENLIST. START is AHEAD for WPPINT (extra bytes in last byte of chunk not recorded).

When the program has finished running, immediately save it on tape with:

1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 2676, 2677, 2678, 26

On the same for WPNT. In BASIC, you will only need to **CLEAR** the memory space, and **LOADM** the programs to use them. They are used by typing **EXEC SHOF04** instead of **LIST** and **EXEC SHOF05** to print out the word processor.

1000

**NOTE:** The IRQ is intentionally disabled during the running of these programs, so **TIMER**, **PLAY** etc. will not work concurrently.

[illegible][illegible][illegible]

REF. FROM FOR INFO--  
 DISSEMINATE THIS INFORMATION FOR YOUR PROTECTION

1997	16	10	86	104	MC	BP	2P	MC	BP	2P	PA	BP	1	10	86	104
1998	BP	31	68	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	BP	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P
2000	BP	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P
2001	BP	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P
2002	BP	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P
2003	BP	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P
2004	BP	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P
2005	BP	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P
2006	BP	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P
2007	BP	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P
2008	BP	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P
2009	BP	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P
2010	BP	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P
2011	BP	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P
2012	BP	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P
2013	BP	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P
2014	BP	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P
2015	BP	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P
2016	BP	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P
2017	BP	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P
2018	BP	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P
2019	BP	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P
2020	BP	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P
2021	BP	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P
2022	BP	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P
2023	BP	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P
2024	BP	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P
2025	BP	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P
2026	BP	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P	MC	BP	2P
2027	BP	MC	BP	2P	MC	BP	2P									

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# Brick

From left: art director in Aberystwyth  
 1981/82 is yet another version of an old

favourite, which seems to originate in a certain orchard. In this one the ball moves in two directions and a degree of skill is required in order to master this game. A word of warning though, it can be mildly addictive. Apart from asking for another game, all control is by means of the joystick and the fire button.

and the results are presented in Table 1. The results show that the model is able to predict the results of the experiments with a high degree of accuracy. The model is able to predict the results of the experiments with a high degree of accuracy.

old and old. Directions of travel after a rebound is determined by a set of sub-routines, lines 580-600, which are called according to the flag set in line 370.

Should you stop the game by pressing the "RESET" key then be sure to press the "RESET" button before you attempt to load or save from tape because the IC is upset by the higher speed set in line 10.











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# MIKE GERRARD'S ADVENTURE TRAIL

WHEN I WAS in Wigan at Christmas I noticed a distinct lack of Samurai around the town, but that doesn't stop a company from calling itself Samurai Software. If you send £7.95 to their offices at 445 Library Street, Wigan, you will receive in return a copy of their adventure, *Castle of the Skull Lord*, along with a free Dragon dust cover, which is a generous additional touch. I wish I could be equally generous about the adventure, but your ruthless reviewer has to be honest and say it's not the best he has ever seen.

The Skull Lord is a necromancer, who once attacked and defeated a race of noble dwarves, and now it's your duty to get into the Skull Lord's castle and retrieve a fabled crown for the dwarves, which was among the treasure stolen by the evil Skull Lord. The game is text-only, as are all the adventures in the month, and accepts the usual two-word commands. For some reason there is no SAVE routine, which is a glaring omission as the BASIC program leaves quite a chunk of memory to play with in the Dragon. Once you've worked out the solutions to the first few problems, you don't want to continually go through them every time you load the tape, or encounter an unexpected death while you're playing.

The game begins with you on a barren plain, signs of life visible all around you, as indeed are exits, and you can also see a river. Head north and there's a withered tree, and if you SAW TREE (having first taken the precaution of climbing it) you miraculously produce a stump and an earl. Amazing stuff. I'd have expected a stump and a felled tree, myself, but this is not an adventure for the realist.

Armed with an ear, you seek a boat and, having found one, you discover the limitations of the inputs allowed for in the program. Type ROW or ROW SOUTH (you're on the north bank of a river) and you're told "You can't do that yet," which is misleading as the command which works is ROW BOAT. The word "first" implies you need another object or to perform another task, not simply that the command is wrong.

Other examples of careless programming include a sequence in the mountains where your progress is blocked by an avalanche, and having found a space to DIG SNOW, the avalanche reap-

pears every time you pass the location. The need for a SAVE routine is emphasized by the fact that if you reach the castle entrance hall and go WEST, you find "You are in a jail. There are no exits but the south wall looks very unstable," ignoring the question of how you suddenly got in there if there are no exits, and that you shouldn't be imprisoned without warning, you obviously need a SAVE routine to experiment with problems like that. The tasks aren't difficult, and even with a free dust cover I can't really recommend this one.

Not am I wildly enthusiastic about *Franklin in Wonderland* from Salamander, the first of what would have been a trilogy had the company not decided the Dragon adventure market was too tiny. As it is, *Franklin in Wonderland* is available for just a fiver, without cover and instructions, but including the plastic wallet the cassette comes in. Before I go ahead with my prosaic comments, bear in mind that I didn't think much of Dan Diamond either, which I know puts me in a minority as far as Dragon adventures go.

My major complaint is that whenever you go at the start, you are in a maze, with no way of getting a route through.

Drop your sweets, and that's the last you'll see of them. The first time I played I got through by fule, and didn't bother saving a game so I could start beyond the maze, but several times after that I spent a fruitless 10 minutes at the keyboard travelling around, seeing the same location description literally hundreds of times, before giving up in frustration. Breaking into the program (it's in BASIC and unprotected) showed that there seems to be a random element at play in the first location, deciding whether you're able to get out of it or not. I'm prepared to be corrected on that, as it's hard to be certain without a full program listing, but it's not my idea of adventure playing.

Getting into the game has you falling down a deep dark hole into Wonderland, leading to illogical encounters with the Mad Hatter, March Hare, Cheshire Cat and so on. But, I was disappointed with this, and with Salamander's other "no-trail" adventure, *White Cliffs*, which gave me an OUT OF MEMORY error when loaded, that's taking no-fills too far!

Best of this month's batch (which isn't difficult) is *The Shrunken Scientist*, a bargain at £5.95 from a company new to me, Quickbeam Software, of 67 Old Marston Road, Broomhouse, Harps SP40 6RN. The title sets the story, as due to a slip-up in your lab you find yourself only one-inch tall, only able to regain your full height by getting to the top of the lab table and eating some of the crystals that are there, if being shrunken in size teaches you nothing else, it shows you what an unkind joke you are about the lab. On your travels you find rusty screws, bits of walnut shell, spinning needles, even insects. I'd sack the cleaner myself. Great fun is had with the new perspective you've got: particles become lakes, insects become mountains (and there are plenty of those, though DOT works wonders).

I've been having great fun with this adventure, discovering how to deal with the spider, the frog, and how to get out onto the window ledge without becoming a steel's breakfast, but I haven't yet figured out how to avoid mosquitoes to enable me to get at the shirt button safely. The game has glaring faults, like no SAVE feature and several elements which lock the machine forcing you to RESET (this happens in two places), but despite that it's enjoyable. ■



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Unlike ordinary computer aided design programs C.A.D. 32 is really easy to use. The program is supplied on cassette with a printed overlay card for the 14b handset. Because the design functions are labelled and controlled from the handset, there is no

requirement for an on-screen menu which allows full use of the screen area for design work, you can now sit back and relax while your Dragon does the hard work. The screen dumps shown here were all produced with C.A.D. 32 using the delta 14b handset and interface. (Project X was designed and produced within 90 minutes). Finished or part finished designs can be saved to tape or disk and reloaded for printing or amendment. There is insufficient space here to describe fully everything C.A.D. 32 can do, so why not come along to the next 6809 show and see it for yourself.



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# Bookbytes

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**Book:** *The Penguin book of Personal Computing*  
**Author:** John Gurnam  
**Publisher:** Penguin  
**Price:** £2.95

THIS WILL be a very short review — this book is absolutely superb and I really have no faults to point out. Not written for the ignorant, it will, however, provide the educated reader with the ideal introduction to computing up to a standard somewhere around that of O-level Computer Science (the syllabus of which assumes that its student does not own a computer).

Within its pages are covered the development of the micro and personal computer, computer architecture, I/O, program development, programming languages, software, networking, system selection and a comprehensive contents list, index, and five appendices, as well as a list of every illustration.

The computer book has matured and come down in price. Three years ago, had a book of this quality been available, it would have cost many more pounds than this excellent tome. The author is an experienced ICL programmer, and it shows! His text is precise, well written, and very well documented.

This book stands proud upon my bookshelf. I have nothing more to say.

Jason O'Shaun

**Book:** *Forward 100*  
**Author:** Ray Hammond  
**Publisher:** Hiking  
**Price:** £12.95

MUCH HAS been said in the media recently about the turtle-graphics based language LOGO — the successor to Basic and Pascal in the "every-room-pupil-a-head-is-provided-as-standard" argument. This book does not set out to continue the argument, nor does it try to teach the new LOGO language, rather it sets out to explain what all the fuss is about. Hammond suggests that LOGO has tremendous value in the educational field because it teaches children to think logically and creatively, albeit at the same time being

fun. The theme of the book is neatly explained by Hammond in the first chapter.

"It is easy to motivate a child to learn LOGO; the problem is to explain its importance to adults."

The point of LOGO, according to the author, is not the syntax and power of the language itself, but the new approach to education that it allows. Hammond sees it as paving the way for an education revolution.



"Schools of the future will be centres of exploration with computers and databases providing information. Teachers will become guides rather than instructors."

If all this sounds mind-numbingly boring, well it isn't. The author's obvious enthusiasm for the subject is infectious, and I found it hard to put the book down. Although at £12.95 it's rather expensive to buy, it's definitely worth going to your local library and ordering a copy.

David Rowntree

**Book:** *FORTH for Micros*  
**Author:** Steve Oakley  
**Publisher:** Newnes  
**Price:** £6.95

BY NOW, every Dragon User must be aware that he or she is not stuck with the limitations of Basic as supplied with the machine. If program speed is the problem, the solution is either to buy a Basic compiler, or use another language altogether. Assembly language, the fastest of all, is

very fiddly in use and debug, so many people turn to intermediate languages like FORTH.

FORTH for Micros attempts to teach the language to those with programming experience in either Basic or Pascal, and points out that it is not an introduction to the subject of programming itself.

The book starts by introducing concepts such as stacks and reverse polish notation (the mathematical notation used by FORTH), and quickly moves on to simple programs. The early examples are given in Basic, Pascal and FORTH to make it easier to see what's going on. All of the usual topics are then introduced: selection statements, looping constructs, arithmetic, data types, input/output, ending up with a look at implementing large programs. The example programs shown include a two-dimensional array interpreter — a facility not available in standard FORTH. At the end of each chapter there are a selection of self-test exercises.

FORTH for Micros is a well written book that covers the main points of the language in an easy style, but there are a lot of FORTH tutors on the market about which one could say the same thing. There is nothing that makes this book stand head and shoulders above the rest.

David Rowntree

**Book:** *Arcade Games in BASIC*  
**Author:** Bruce King Bell  
**Publisher:** Acston  
**Price:** £14.95

THIS IS a thinly disguised "15 eager games for you" type of book. Not much more need be said. If this is your type of book, then this one is excellent in its field offering competent versions of Break-out, Snake, Scramble (which has machine code in it — a fact which makes the title of the book somewhat dubious), et al.

The programs are of a standard slightly above those you would find in computer magazines and they are very well documented, but almost every

one relies on the speed poke for one reason or another, and they are in BASIC, which is not a good language for arcade games.

The book is well written and I was pleased to see that it does not talk down to its readers. It credits its reader with a fair amount of intelligence at times, although the game introductions leave a lot to be desired, eg: "Nobody remembers why the war began. All that is known is that in the nuclear age the earth has quickly become war ravaged." All it needs is an "It was cold, too cold", and it will be a best seller!

The book's appendices are fairly competent and complete, giving COBOL Basic versions of the games for those with a Co-Co and no Extended Basic Cartridge (the Dragons comes with Extended Basic as standard), an "Index" of the major tactical topics covered in each chapter, is indexed by lower table, joystick, spring and the like, and a final appendix of useful codes and peeks not all of which seem to work (this could be because the book was quite obviously written for a Co-Co and re-coded).



Overall then, a superior member of an inferior genre of book, but, as I have said, if the "Tap Fox and Bang with 30 games for you" is your scene, then this is your book. And if not, it may still be worth a look by programmers as it does present some great examples of good programming (emphasis is on the word good, for the programs, by lack definition, are not structured).

Jason O'Shaun

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If you've got a technical question write to Brian Gedge. Please do not send a SASE as Brian cannot guarantee to answer individual inquiries.

# Dragon Answers

## Switching to map 1

I HAVE an awkward question which I hope you can answer: I recently acquired a copy of a program (quite accidentally!) which has the capability of switching to map1 and copying whatever you want into the upper 16K of RAM. Since I have been toying with the idea of reconstructing the Basic to get rid of the bugs and improve its capabilities, I found this interesting and, although I haven't solved all the problems, one particular piece of the puzzle is still elusive.

A great deal of information was provided by the article in the January issue about map type 1. My question is — Under map type one does the SAGE chip still access the interrupt vectors from \$BFF0-\$BFFF or are they mapped from \$FFFF-\$FFFF or do they revert to \$BFF0-\$BFFF?

Robin Tekman  
15 Arbury Terrace  
Leeds

THE SPADON'S hardware is presently configured so that the 6800 reads the contents of locations \$BFF0 to \$BFF7 of the 6809 for the interrupt and reset vectors, no matter whether you are in map 0 (\$B000) or map 1 (\$B000). Don't forget, however, that these interrupts have vectors which themselves point at vectors in RAM between \$B0 and \$7F0 which you can change yourself.

## Negative offset -a complement

THE \$A (\$0000) the CLOADM command, it is possible to relocate your mic program at a different address by using an offset. This is all well and good, but how do you get around the problem of relocating to a lower address? I have tried entering a negative integer, but the only result is an FIC error.

Bill Lear  
20 Arbury Lane  
Leeds

THIS PROBLEM with the CLOADM command comes up frequently, and is worth another mention. To achieve a negative offset you need to give the tool's complement value of the negative number. That is \$5520-\$A,



\$A, to \$A what should be: CLOADM'', -0000 you would type instead: CLOADM'', 5520-\$A. This is just one of those bugs in the Microsoft Basic.

## A skip in time saves . . . ?

TIMER=0: Skip "Program". Post Timer \$0. This would seem to provide a means of timing a program on a SAGE routine, but the value printed seems to indicate that the Timer stops while "Skip" is taking place.

If this is so, surely the Timer will stop while any other operation takes place and therefore will never return an accurate value?

However, Timer=0: For \$L=1 to 100: Post: Post: Timer \$0: returns a value about one tenth of "Timer=0: For \$L=1 to 1000: Post: Post: Timer \$0". What, therefore, are the limitations of Timer?

P Cooke  
Pennybank  
Dorset Hill  
Pulford  
Bristol

THE TIMER function can be used to accurately time any operation. It does not stop for normal basic commands, only those which use the cassette, such as CLOAD and CSAVE. This is necessary as interrupts must be disabled when reading or writing to cassette (because of the critical timings involved).

As the timer function is updated by the interrupt routine, the value will not change during cassette operations. The same applies to disk reading and writing, but is less noticeable because of the speed of a disk drive. There are only limitations of the Timer function.

## Don't press the reset button

IS IT possible for me to make my Dragon crash on pressing the reset button? Also, is there any way in which I can use variables instead of program names when

loading machine code from a Dragon's disk drive? I have tried the following routine, but so far have been unsuccessful:

```
10 INPUT A$
20 LOAD A$ "B"
```

Richard Stevens  
Metheringham  
Rochester Avenue  
Roxton Abbott  
Devon

IT IS possible to make the Dragon freeze up when Reset is pressed. The only way out is to turn off and on again, so use these points with care, as you cannot regain the program in RAM. To make the Dragon freeze up on reset include these points in your program: POKE 114, \$ABC: POKE 115, \$DEF.

On your second point, it is possible to use variable names as dragoned filenames by using the "A" sign, your program should read:

```
10 INPUT A$
20 LOAD A$ "A"
```

## Unplug your DOS cartridge

WITH THE reduction in price of the Dragon disk drives, many more users now have access to a disk system. sooner or later you realize that some games will not work with the DOS cartridge installed when loaded from tape as both the game and the DOS want to use the same RAM. The only option seems to be to unplug the cartridge. Doing this frequently will put the edge connector under a lot of stress and could damage the cartridge or your Dragon.

In the November issue of Dragon User I mentioned that it is

possible to unplug the DOS cartridge using software, in response to the letters from Philip Ellis, Adam Cooke, & Steven and many others here is such a program. Type the program in and save it on disk as, for example: SAGE "DETADY".

When you want to "unplug" the DOS, type RUN "DETADY" and press reset when requested. The program copies the Basic cold start procedure from ROM and modifies it to ignore the DOS cartridge. To get the DOS back, just type POKE 113,0 and press reset.

The program should effectively detach any dos or similar cartridge, including DragonDOS, On the Fly, Ultra Drive Dos, etc.

```
10: DOB SOFTWARE DETACH A.L.L.
20: CLS: CLOADM 4
30: PRINT "A"
40: FOR I=0 TO 10: FOR J=0 TO 10: POKE I+J*10,0: NEXT J
50: NEXT I
60: POKE 113,0
70: FOR I=0 TO 10: FOR J=0 TO 10: POKE I+J*10,0: NEXT J
80: NEXT I
90: PRINT "A"
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## Competition Corner

Answers to Competition Corner,  
Dragon Users, 12-13 Little Newport  
Street, London WC2H 7PP.

# Reach out for the sky

*Microdeal provides the prize to Gordon Lee's computation competition*

IT HAS BEEN said that there are more ways of arranging the order of a pack of playing cards than there are atoms in the known universe. If this mind-blowing, though totally useless, fact grips your imagination then in all probability you are one of the rare breed of 'abstract numerologists'. On the other hand, if it makes your head swim, then you are definitely not a suitable candidate to explore the dizzy heights of number juggling.

While on the subject of large numbers and playing cards, did you know that the odds of dealing a perfect bridge hand — is

one in which each player receives a complete suit — is only once in 2,238,187,808,896,386,386,321,860,300 deals? Put another way, if the entire population of the earth sat down in bridge fours and did nothing but deal hands at the rate of one a minute, it would take over three million, million, million years for such a hand to occur. Another odd fact would come to light if the entire world's population were to stand along the equator. Even if we were to assume that the equator ran entirely over land, it would only allow a space of one third of an inch for each person. However, if we were to allow a space of one square yard each, the population would cover one thousand five hundred square miles — an area about the size of the county of Suffolk.

How many times have we heard it said that someone is 'worth their weight in gold'? Taken literally, with gold costing \$800 an ounce, an average individual weighing eleven and a half stone would be worth over three quarters of a million dollars. Moreover, as gold is the most ductile of all metals, this amount could be drawn out into a fine wire over one hundred thousand miles long! Consider for a moment one million pounds. Although in £50 notes it would fit into a suitcase, if it were paid in penny pieces it would have a stacked height of 80 miles and a total weight of 350 tons. Also, if these coins were laid out in a straight row they would stretch 1040 miles — about the direct distance from Glasgow to Rome!

### When in Rome . . .

On the subject of Rome, have you heard the joke about the ancient Roman who kept missing the bus because he thought that 11.11 was two minutes past two? Apart from being totally impractical for even basic arithmetic, the Roman number system has no letter for zero. Other curiosities include the largest date so far on the calendar which was 1988 with the thirteen-letter MDCCCLXXXVIII, and the fact that watchmakers tend to use IIII for '4' on clock faces rather than the correct number IV. Another odd 'clock' statistic is that the minute hand of Big Ben has travelled over 18,000 miles since 1485.

To work out that last figure you would need to know the length of the hand (148), and the value of pi (3.14159 . . .). If you wanted to be really accurate, pi has now

been calculated to over eight million decimal places. Other large numbers include the largest prime number found so far,  $2^{1000000} - 1$ , which has 30,761 digits. From this can also be calculated the highest 'perfect' number so far discovered,  $2^{1000000} (2^{1000000} - 1)$ , a number with 70,902 digits! A perfect number is one whose whole number divisors, including 1 but excluding itself, add up to that number. The two smallest perfect numbers are 6 (1+2+3) and 28 (1+2+4+7+14). After this comes 496, 8128, 33550336, and 8589869056.

### Record breaking

When large numbers are concerned, the science of astronomy has some real record-breakers, so much so that they are often difficult to imagine. However, if we could reduce the earth to the size of a grapefruit we would find the following curious facts: The moon would have a diameter of one inch and would orbit at a distance of nine and a half feet. The sun would have a diameter of 30 feet and be three quarters of a mile away, while Pluto, the outermost planet, would be at a distance of twenty-nine miles. On the same scale, Proxima Centauri, the sun's nearest neighbouring star (actual distance 4.3 light years) would have to be placed on the surface of the moon!



This would seem a good point at which to break away from this review of totally useless facts, all of which can be easily calculated by computer. At the beginning it was stated that there were more ways of arranging the order of a pack of cards than there are atoms in the known universe. This month's competition is to compute this exact number. It is quite easy using logarithms to find an approximation, but we require the number precisely. (Hint: the number you are after is  $52! - (52 \times 51 \times 50 \times 49 \times \dots \text{etc.})$ )

## Prize

MICRODEAL is offering to readers the chance to win shortly of Flight, its exhilarating new flight simulator for the Dragon.

## December winners

THE FOUR cards were the stars of clubs, the ace of diamonds, the five of hearts and the five of spades. Benham Pyke is 69 years old (110 next birthday). The 10 winners, who will each receive one of Bessie Jolly's 'vintage' books, are: A. Hutchins of Conisburgh, Cym (Gip) of Bristol, Alan Kennedy of Lisburn, C. James of Llanelli, Jason Emery of Emsworth, St. Hatcheram of Chorley, M. Denton of Trowbridge, David Faulkner of Portsmouth, R. Gossling of Bristol and Mark Heaps of Lincoln.

## Rules

TO WIN a copy of the game you must both show the answer to the competition and how to solve it with the use of a Bessie program developed on your Dragon. Please do not send in a cassette containing the answer. As a 'to-beat-it' complete the following sentence in 15 words or less: 'I would like to fly because . . .'

Your entry must arrive at Dragon User by the last working day of March. The winners and the solution to the puzzle will be published in our June issue. Entries will not be acknowledged and we cannot enter into correspondence on the result.

# RETURN OF THE RING

THE RING  
OF  
DARKNESS  
PART II

At last the saga  
continues...

The Guardian of Sheldir is defeated, the Hall spawned hordes of the Evil Sage lie at bay. Now Ringbearer, wielder of the Four Bright Rings, must face the greatest challenge to return the Ring Of Darkness to its creators on the hidden planet Ringworld. . . . And somewhere at the ends of time the forces of evil are preparing their revenge.

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May luck travel your path.

Please note: RETURN OF THE RING is a complete adventure. You need not buy THE RING OF DARKNESS to play it.



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